C.R. Bard, Mass Balance Calculations for Toxic Release Inventory (TRI) Form R Reporting

Facility: Madison, GA

Reporting year: 2018 All non 14, 34, 44

Input data requiring annual update:		
Quantity of bad drums returned	1	
Weight in partial drums returned	0	lb
Ethylene oxide usage	198,952	lb/yr
Number of Cycles (Cycle 7, 12, 26, 28, 34, 73, 75, 85)	1,934	
Number of Cycles (Cycle 8, 14, 34, 44, 74)	19	

Input data to review, but may not have changed:		
EO accidental release, Cycle 7	0	lb
EO accidental release, Cycle 8	0	lb
Sterilizer removal efficency	99.1%	
RTO efficency, aeration	99.73%	
RTO efficency, vessels	99.99950%	
Product transfer time, sterilizer to aeration	5	min
Aeration time, Cycle 7	17	hr
Aeration time, Cycle 8	20	hr
Unload time	30	min

Online report data:

Form R section	Form R section description	Value to enter	
Section 5.1	Fugitive or Non-Point Air Emissions	381.9	lb
Section 5.2	Stack or Point Air Emissions	2.1	lb
Section 5.4.1	On-site Underground Injection: Class I Wells	N/A	
Section 5.4.2	On-site Underground Injection: Class II-V Wells	N/A	
Section 5.5.1A	On-site Landfills: RCRA Subtitle C	N/A	
Section 5.5.1B	On-site Landfills: Other	N/A	
Section 5.5.2	On-site Land Treatment and Application Farming	N/A	
Section 5.5.3A	On-site Surface Impoundments: RCRA Subtitle C	N/A	
Section 5.5.3B	On-site Surface Impoundments: Other	N/A	
Section 5.5.4	Other Disposal	N/A	
Section 5.3	Water Bodies	N/A	
Section 6.1	POTW	N/A	
Section 6.2	Company that receives returned drums	BALCHEM CORP	
	Total quantity (lb)	4,376.0	
	Basis of estimate	C - Mass balance	
	Waste Management Type	M26 - Other Reuse or Recovery	
Section 7A	On-site Waste Treatment Methods and Efficiency	RTO Desctruction of EO	
	Waste treatment efficiency range	99.9%	
Section 7B	On-site Energy Recovery Methods and Quantity	N/A	
Section 7C	On-site Recycling Methods and Quantity	N/A	
Section 8.8	Non-Production Quantities	No	
Section 8.1a	Total On-site Disposal to Wells or Landfills	N/A	
Section 8.1b	Total Other On-site Disposal or Other Releases	384.0	lb
Section 8.1c	Total Off-site Disposal to Wells or Landfills	N/A	
Section 8.1d	Total Other Off-site Disposal or Other Releases	N/A	
Section 8.2	Quantity Used for Energy Recovery On-site	N/A	
Section 8.3	Quantity Used for Energy Recovery Off-site	N/A	
Section 8.4	Quantity Recycled On-site	N/A	
Section 8.5	Quantity Recycled Off-site	4,376.0	lb
Section 8.6	Quantity Treated On-site	198,568.0	lb

Section 8.7	Quantity Treated Off-site	N/A
Section 8.9	Production Ratio or Activity Ratio	0.95
Section 8.10	Source Reduction Activities	N/A
	Barriers to Source Reduction	B7
Section 8.11	Optional Pollution Prevention Information	Can leave all blank
Section 9.1	Miscellaneous Information	Can leave all blank

Assumptions:		
EtO returned in each used drum	8.0	lb/drum
Product absorbtion	0.4%	
EO degassing rate constant, k	0.06151	lb/hr
Miscellaneous fugitive loss	100	lb

Calculations:		
Process inlet:		
Total drums used	497	
Returned in drum	3,976.0	lb
Returned in bad drums	400.0	lb
Returned in partial bad drums	0.0	lb
Total returns	4,376.0	lb
Sterilizer:		
EO into sterilizers	198,952	lb
EO absorbed by product	795.8	lb
EO in sterilizer not absorbed by product	198,156.2	lb
EO exhausted to RTO from vac/air wash	196,372.8	lb
EO exhausted to RTO from vent	1,783.4	lb
Sterilizer exhaust to RTO	198,156.2	lb
Sterilizer exhaust removed by RTO	198,155.2	lb
Sterilizer exhaust from RTO	1.0	lb
Transfer:		
EO offgas during product transfer to aeration	0.51%	
EO offgas during product transfer to aeration	4.1	lb
Aeration:		
EO remaining in product entering aeration	791.7	lb
Offgas during aeration, Cycle 7	64.9%	
Offgas during aeration, Cycle 8	70.8%	
Offgas during unloading	3.0%	
EO offgas during aeration, Cycle 7	508.5	lb
EO offgas during aeration, Cycle 8	5.5	lb
EO offgas during aeration, total	513.9	lb
To RTO during aeration	405.5	lb
To RTO during vent	8.4	lb
Total aeration to RTO	413.9	lb
Aeration removed by RTO	412.8	lb
Aeration exhaust	1.1	lb
In product:		
EO in product	277.8	lb
Exhausted:		
EO exhausted to atmosphere from RTO	2.1	lb
Total removed by RTO	198,568.0	lb
Total EO exhausted to atmosphere	106.2	lb

Production ratio:

	Historical gas loads	Production ratio
2006	60	
2007	545	9.08
2008	1087	1.99
2009	1162	1.07
2010	1697	1.46
2011	1760	1.04
2012	1620	0.92
2013	1264	0.78
2014	1820	1.44
2015	1753	0.96
2016	2065	1.18
2017	1,953	0.95
2018	2421	1.24
2019		
2020		

Use this to report 2018

Obtain this from operations / purchasing personnel
Obtain this from operations / purchasing personnel
Obtain this from operations / purchasing personnel
Obtain this from operations personnel
Obtain this from operations personnel

Update only if there was an accidental release of EO
Update only if there was an accidental release of EO

Update only if an efficiency Performance Test was performed during the year, per Air Quality Permit Section 7

Update only if there have been changes to process durations during the year

Used these number over there>>>>>>

For future reporting years, click the "Use Current Year Quantities" box

Initial weight (400 lb) - tare weight (18 lb) + manifold weight (10 lb) = 392 used per drum.
Therefore, 8 lb/drum returned
Frank Davis memo Subject Ethylene Oxide, 9.apr.2019
Frank Davis memo Subject Ethylene Oxide, 9/25/08

EO will off-gas from products during aeration per equation: $C = C_o e^{(-kt)}$, where C = Final EO concentration, C_o = EO concentration at time 0, k = EO degassing rate constant, and t = degassing time in hrs.

Cycle 14, 34, 44

		Total
0		1
0	lb	0
25,769	lb/yr	224,721
0		1,934
465		484
0	lb	0
0	lb	0
99.1%		
99.73%		
99.99950%		
5	min	
18	hr	
18	hr	
30	min	
Value to enter		
172.1	lb	554.0
1.1	lb	3.2
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		
BALCHEM CORP		
512.0		4,888.0
C - Mass balance		
M26 - Other Reuse or Recovery		
RTO Desctruction of EO		
99.9%		
N/A		
N/A		
No		
N/A		
173.1	lb	557.1
N/A		
N/A		
N/A		
N/A		
N/A		
512.0	lb	4,888.0
25,595.9	lb	224,163.9

N/A		
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B7		
Can leave all blank		
Can leave all blank		
8.0	lb/drum	
2%		
0.06151	lb/hr	
0	lb	100
64		561.0
512.0	lb	4,488.0
0.0	lb	400.0
0.0	lb	0.0
512.0	lb	4,888.0
25,769	lb	224,721.0
515.4	lb	1,311.2
25,253.6	lb	223,409.8
25,026.3	lb	221,399.1
227.3	lb	2,010.7
25,253.6	lb	223,409.8
25,253.5	lb	223,408.7
0.1	lb	1.1
0.51%		
2.6	lb	6.7
512.7	lb	1,304.5
67.0%		
67.0%		
3.0%		
0.0	lb	508.5
343.3	lb	348.7
343.3	lb	857.2
338.2	lb	743.7
5.1	lb	13.5
343.3	lb	757.2
342.4	lb	755.2
0.9	lb	2.0
169.5	lb	447.3
1.1	lb	3.2
25,595.9	lb	224,163.9
3.7	lb	109.9

Production ratio
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